REMARKS

Claims 1-3, 5-10, 12 and 13 stand rejected under 35 U.S.C. 102(e) as being anticipated by Menjak et al. (U.S. Patent No. 6,997,076).

Claims 4 and 11 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Menjak et al.

Applicants respectfully traverse the above grounds of rejection for the following reasons.

The priority date of the Menjak et al. reference is February 10, 2003, while the German priority date for the present application is June 27, 2002. More specifically, the present application claims priority to German patent application No. 102 28 706.6. In response to the outstanding Office Action, Applicants submit herewith a certified English translation of German Patent Application No. 102 28 706.6. In accordance with 37. CFR 1.55 (MPEP 201.15), Applicants respectfully submit that the submission of the English translation, along with a translator's certificate, establishes a priority date that is prior to the date of the Menjak et al. reference. As a result, the Menjak et al. reference is not prior art and therefore, the rejections based on the Menjak et al. reference must be withdrawn.

Since the claims are not rejected on any other grounds, claim 1-13 should be allowed.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

By______________________

Edward J. Ellis
Registration No.: 40,389
DARBY & DARBY P.C.
P.O. Box 5257
New York, New York 10150-5257
(212) 527-7700
(212) 527-7701 (Fax)
Attorneys/Agents For Applicant

EXHIBIT A

DR. WALTER E. KUPPER
65 Barnsdale Road
Madison, NJ 07940
Telephone: 973 301-1989 Fax: 973 822-9096 E-mail: wekupper@att.net

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TO WHOM IT MAY CONCERN:

TRANSLATOR'S CERTIFICATE

The undersigned hereby certifies that he is proficient in the German language, that he has personally prepared the attached translation, beginning with "Patent Claims" on page 1, and entitled (on page 4)

"Gear Drive Mechanism with Anti-Rattle Device"

of German patent application Serial No. 102 28 706.6, identified by the company name "AFT ATLAS Fahrzeugtechnik GmbH", with an identifier number "A 0083 A", and entitled (on page 4 of the German text)

"Zahnradgetriebe mit Antirasseleinrichtung"

and that the translation is accurate.

Walter Kupper

Walter Kupper

AFT Atlas Fahrzeug-
technik GmbH

Gewerbestrasse 14

58791 Werdohl

A 0083 A

Patent Claims

1. Gear drive mechanism with an anti-rattle device, comprising:
   - a first gear (6) rotatable about a first axis,
   - a second gear (8) rotatable about an axis at a predetermined distance from the first axis and meshing with the first gear,
   - a friction rim surface (16) that is rotationally coupled to the first gear, and
   - a friction rim surface (18) that is rotationally coupled to the second gear,

   wherein the friction rim surfaces are in mutual contact with each other and thereby enabled to transmit a friction-based torque between each other.

2. Gear drive mechanism according to claim 1, wherein at least one friction rim surface (16, 18) is formed on a friction wheel (12, 14) attached to an axially facing side of one of the gears (6, 8).

3. Gear drive mechanism according to claim 1 or 2, wherein the friction rim surfaces (16, 18) have conical shapes, and wherein the median radius of each of the friction rim surfaces that are in mutual contact with each other is equal to the pitch circle radius of the respective gear (6, 8).

4. Gear drive mechanism according to claim 3, wherein the cone angle is substantially 25°

5. Gear drive mechanism according to claim 3 or 4, wherein one conical friction rim surface (18) is biased against the other conical friction rim surface (12) with a pre-tensioning force acting in a direction that causes an increased contact pressure.

6. Gear drive mechanism according to claim 5, wherein the pre-tensioned friction rim surface (18) is biased in the axial direction.

7. Gear drive mechanism according to claim 6, wherein the pre-tensioned friction rim surface (18) is formed on the outer circumference of a dish-shaped spring disc.

8. Gear drive mechanism according to one of the claims 1 to 7, wherein the friction rim surfaces (16, 18) are formed on ring discs that are arranged coaxially with the respectively associated gears (6, 8).

9. Gear drive mechanism according to one of the claims 1 to 8, wherein the friction rim surfaces (16, 18) are hardened.

10. Gear drive mechanism according to one of the claims 1 to 9, wherein the friction rim surfaces (16, 18) are provided with a coating.

11. Gear drive mechanism according to one of the claims 1 to 10, wherein a friction rim surface ((16, 18) is arranged on each side of each gear (6, 8).

AFT Atlas Fahrzeug-
technik GmbH
Gewerbestrasse 14
58791 Werdohl A 0083 A

Gear Drive Mechanism with Anti-Rattle Device

The invention relates to a gear drive mechanism with an anti-rattle device. Rattling or clattering noises which are found irritating occur often in gear mechanisms as a result of non-uniformities in the movement of the shafts that are rotationally coupled to the gears and as a result of the play between the tooth flanks of the gears.

The objective of the present invention is to provide a gear drive mechanism that is free of rattling and clattering noises of the aforementioned kind.

To solve this problem, the invention proposes a gear drive mechanism with an anti-rattle device. The mechanism has a first gear (6) rotatable about a first axis and a second gear (8) rotatable about a second axis at a predetermined distance from the first axis and in meshing engagement with the first gear.

The mechanism further has a first friction rim surface (16) that is rotationally coupled to the first gear, and a second friction rim surface (18) that is rotationally coupled to the second gear, wherein the friction rim surfaces (16) and (18) are in contact with each other, so that a friction-based torque is transmitted between them.

In an advantageous embodiment of the gear drive mechanism according to the invention, at least one of the friction rim surfaces is formed on a friction wheel that is attached to one side of one of the gears, positioned coaxially with the respective gear.

With preference, the friction rim surfaces are conically slanted, with the middle radius of the frusto-conical surface being equal to the pitch-circle radius of the respective gear.

The cone angle is for example about 25°.

Advantageously, one of the conical friction rim surfaces is pre-tensioned against the other in a direction of increasing contact pressure.

It is advantageous if the pre-tensioned friction rim surface is pre-tensioned in the axial direction.

In a preferred embodiment, the pre-tensioned friction rim surface is formed on the outside circumference of a dish-shaped plate spring.

It is advantageous if the friction rim surfaces are formed on annular discs that are arranged coaxially with the respective gears.

As a further preferred feature, the friction rim surfaces are hardened.

In a further embodiment of the gear drive mechanism according to the invention, the friction rim surfaces are surface-coated.

It is of practical advantage to arrange friction rim surfaces on both sides of each gear.

The invention is widely applicable for all gear pairings that have a tendency to make rattling noises due to fluctuating torque loads and play in the tooth flanks. The invention is particularly well suited for applications with gear pairs in

which the friction rim surfaces have tooth profiles meshing with each other.

The invention will hereinafter be discussed in further detail in connection with the attached schematic drawings, which are meant to serve as examples and wherein

Fig. 1 represents a sectional view of a first embodiment of the gear drive mechanism according to the invention in a plane containing the gear axes; and

Fig. 2 represents a gear drive mechanism according to the invention in an embodiment that has been modified relative to the first embodiment, shown in a sectional view in a plane containing the gear axes.

According to Figure 1, a gear 6 carrying a tooth profile on its circumference is rotatable about an axis A-A and meshes with a second gear 8 which likewise carries a tooth profile 10 on its circumference and is rotatable about an axis B-B. The line C-C indicates the pitch line of the two tooth profiles 4 and 10; the dimension a is the pitch radius of gear 6, and b is the pitch radius of gear 8.

As a means for preventing rattling noises that occur as a result of play between the tooth flanks of the gear profiles 4 and 10 and as a result of a non-uniform rotation due to torque fluctuations in the shafts (not shown in the drawings) that are rotationally coupled to the gears 6 and 8, the profile engagement between the gears 6 and 8 is paralleled by a frictional engagement between the friction wheels 12 and 14. The friction wheel 12 is rigidly connected to one side of the gear 6, centered on the axis A-A, while the friction wheel 14 is rotationally constrained to one side of the gear 8, centered on the axis B-B. The friction rim surfaces of the friction wheels 12 and 14 are rolling on each other, and the magnitude of the torque that can be transmitted through the rolling friction contact is at least large enough so that the torque fluctuations which are superimposed on the quasi-static torque acting between the gears 6 and 8 and which cause the rattling noises can be taken up and transmitted through the friction wheels.

To give a more accurate description, the friction wheel 12 is configured as a friction disc that is rotationally fixed on the gear 6, e.g. by means of a shrink-fit connection. The friction wheel 12 has a conically tapered friction rim surface 16 whose diameter decreases towards the side facing away from the gear 6 and whose mean diameter is equal to the pitch circle diameter of

gear 6. The friction wheel 14 is configured as an annular dish-shaped spring whose radially inner portion is rotationally coupled to the side of the gear 8, e.g., by means of a shrink-fit connection and in addition by means of a keyed connection. The friction rim surface 18 of the annular spring disc or friction wheel 14 is tapered in the opposite sense of the friction rim surface 16. As shown in Figure 1, because of the pre-tension of the annular dish-shaped spring 14, the friction rim surface 18 is elastically biased to the left against the friction rim surface 16. In the condition where the friction rim surfaces 16 and 18 are in contact with each other, the median diameter of the conical surface 18 equals the pitch circle diameter of the gear 8.

Detail D in Figure 1 gives a magnified view of the friction rim surfaces 16 and 18 in the area of their friction-based engagement. An advantageous choice for the cone angle α is about 25°. The selection is based on finding a favorable compromise between the friction-force magnification effect, the accuracy requirements on a concentric and wobble-free alignment, as well as the wear reserve and the stress-load on the spring disc. In special cases, the cone angle α may be as much as 90°.

The conical configuration of the friction rim surfaces 16 and 18 in conjunction with the elastic bias of the friction rim surface 18 provides the benefits of an amplification of the friction force, a self-adjusting wear compensation, a tolerance against out-of-round errors, and a wear reserve. The conicity of the friction rim surfaces leads to a non-uniform rotary transmission ratio over the width of contact area, which causes a certain amount of abrasive friction. However, the effect minimizes itself during operation, because the more the radius of a given location of the friction contact differs from the nominal pitch radius of the gear pair, the stronger will be the abrasive wear at that particular location.

It is advantageous if the friction rim surfaces 16 and 18 are hardened and/or provided with a coating that is appropriately selected in accordance with the frictional torque to be transmitted and the desired durability.

In the embodiment of Figure 1, the friction drive is used only on one side of the gears which, because of the conical configuration of the friction rim surfaces, introduces an axial stress load in the gear pair. This condition can be avoided by arranging the friction drive on both sides of the gears as shown

in Figure 2 which, in all other aspects, is identical with Figure 1.

As is self-evident, the friction drive of the foregoing description can be modified in a multitude of ways. The pre-tension between the friction rim surfaces does not necessarily have to be generated by means of a dish-shaped spring but can also be produced in other ways. The friction wheels can be made of one piece together with the gears by machining the gears in an appropriate manner. The friction wheels do not necessarily have to be attached to the gears but can also be rotationally fixed on shafts that are, in turn, rotationally coupled to the gears.

The patent claims filed with the application are suggested formulations without prejudice against obtaining a more far-reaching patent protection. The applicant reserves the right to claim further combinations of features which have so far been disclosed only in the description and/or in the drawings. The dependencies of the subordinate claims indicate a further developed form of the subject of the main claim by adding the respective features of each subordinate claim. They are not meant to waive the right to obtain independent substantive protection for the feature combination of the subordinate

claims. As the subjects of the subordinate claims could constitute independent inventions by themselves in light of the state of the art on the priority date, the applicant reserves the right to make them the subjects of independent claims or divisional applications. They can furthermore also contain independent inventions of a form that is independent of the subjects of the preceding subordinate claims.

The embodiments given as examples are not meant as a limitation of the invention. Rather, within the scope of the present disclosure, numerous alterations and modifications are possible, in particular such variants, elements and combinations and/or materials which for example through combination or variation of features or elements described in the general description, in the embodiments and in the claims as well as presented in the drawings will be apparent to those skilled in the pertinent art as solutions to the problem or to gain advantages and will through a combination of features lead to a new subject or to new process steps or step sequences, also extending to production- and test methods and work procedures.

AFT Atlas Fahrzeug-
technik GmbH
Gewerbestrasse 14
58791 Werdohl

A 0083 A

Abstract

A gear drive mechanism with an anti-rattle device has a first gear 6 rotatable about a first axis, a second gear 8 rotatable about an axis at a predetermined distance from the first axis and meshing with the first gear, a friction rim surface 16 that is rotationally coupled to the first gear, and a friction rim surface 18 that is rotationally coupled to the second gear, wherein the friction rim surfaces are in mutual contact with each other and thereby enabled to transmit a friction-based torque between each other.

FIG 1

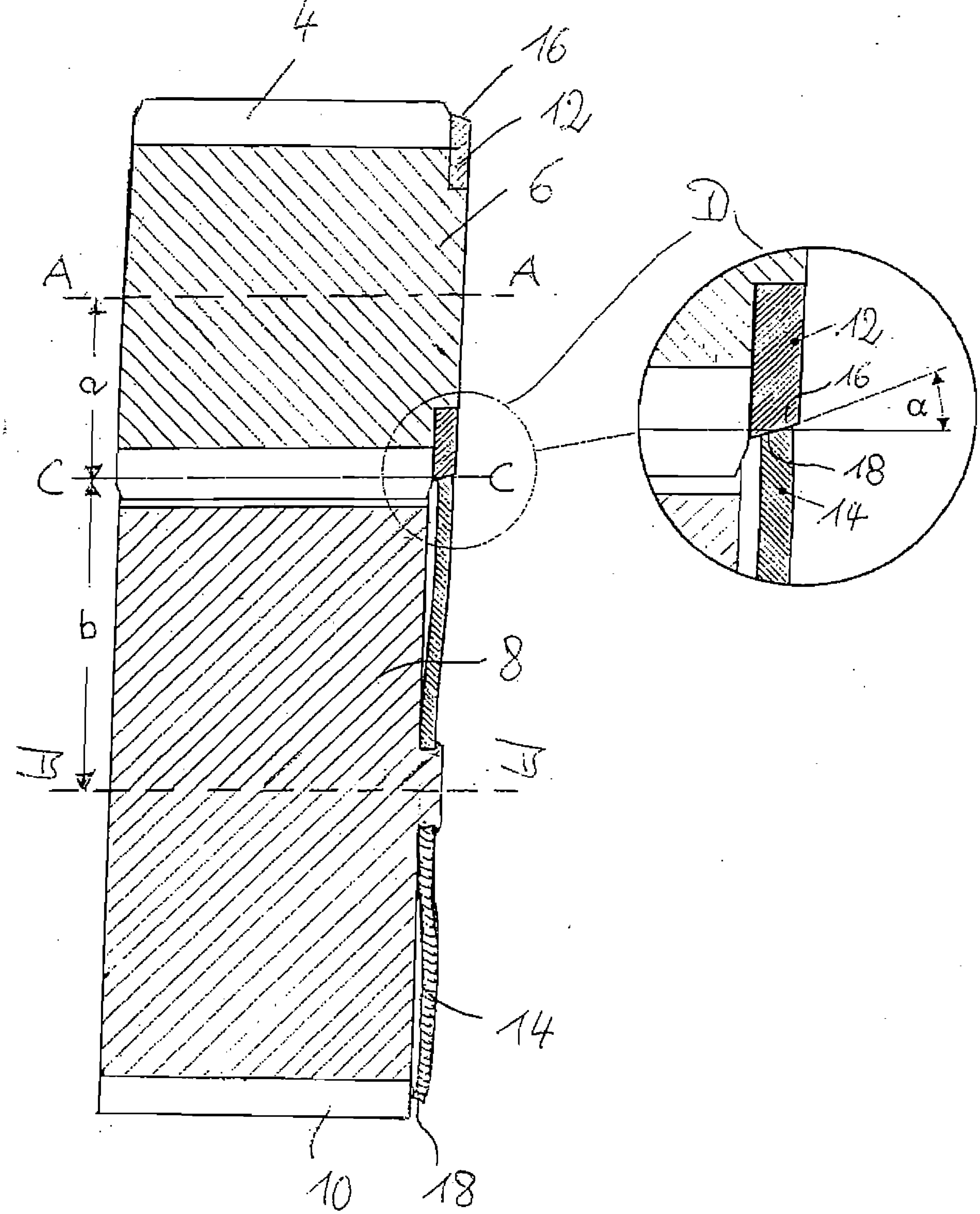

FIG 2